Taxonomic study of the genus *Rhamphophasma* Brunner von Wattenwyl (Phasmatodea: Phasmatidae: Clitumninae) in China, with descriptions of three new species

Waichun George HO①

Hong Kong Entomological Society, P. O. Box No. 73749, Kowloon Central Post Office, Hong Kong, China

Abstract: This study provides a taxonomic study of the genus *Rhamphophasma* Brunner von Wattenwyl, 1893 from China. Three new species, *R. obtusum* sp. nov., *R. pseudomodestum* sp. nov. and *R. serratum* sp. nov., are described. The female *R. dianicum* Chen & He, 1994 is described for the first time. A key to species of *Rhamphophasma* is provided.

Key words: stick insects; Clitumnini; taxonomy; key

中国喙尾䗛属分类研究及三新种记述（䗛目：䗛科：克䗛亚科）

何维俊①

香港昆虫学会，香港 九龙中央邮政信箱 73749 号

摘要：本文系统研究了中国喙尾䗛属，描述该属 3 新种：钝喙尾䗛 *Rhamphophasma obtusum* sp. nov.，疑褐喙尾䗛 *R. pseudomodestum* sp. nov. 及细齿喙尾䗛 *R. serratum* sp. nov.，首次记述了雌性滇喙尾䗛 *R. dianicum* Chen & He, 1994，编制了该属分种检索表。

关键词：竹节虫；克䗛族；分类；检索表

Introduction

Rhamphophasma Brunner von Wattenwyl, 1893 is a small genus in Clitumnini Brunner von Wattenwyl, 1893 and contains six species distributed over South China, Japan, Indochina and the Indian subcontinent (Brunner von Wattenwyl 1907; Shiraki 1935; Otte & Brock 2005; Chen & He 2008; Hennemann *et al.* 2008; Mandal & Yadav 2010). In this paper, three new species, *R. obtusum* sp. nov., *R. pseudomodestum* sp. nov. and *R. serratum* sp. nov., are described. The female of *R. dianicum* Chen & He, 1994 is described for the first time. A key to Chinese species of this genus is provided.

Material and methods

Morphological terms follow Bragg (2001) and Zompro (2004). Ootaxonomic descriptions refer to Clark (1976a, b, 1979, 1988, 1998), Clark-Sellick (1997) and Zompro (2004). Measurements are given in millimeters (mm) for all taxa. The type and non-type material are

---

Accepted 23 April 2017. Published 25 June 2017. Published online 31 May 2017.

① E-mail: georgehwc@hotmail.com

deposited in Beijing Forestry University, Beijing, China (BFU), Hong Kong Entomological Society, Hong Kong, China (HKES), Shanghai Entomological Museum, Chinese Academy of Sciences, Shanghai, China (SEM), Insect Collection of Shanghai Normal University, Shanghai, China (SNUC) and the Museum of Biology, Sun Yat-Sen University, Guangzhou, Guangdong, China (SYSBM).

Taxonomy

Rhamphophasma Brunner von Wattenwyl, 1893

Rhamphophasma Brunner von Wattenwyl, 1893: 93. Type-species: *Rhamphophasma modestum* Brunner von Wattenwyl, 1893, by monotypy.

Distribution. China (Guangdong, Guangxi, Guizhou, Hunan, Jiangxi, Sichuan, Xizang, Yunnan and Chongqing); Vietnam; Myanmar; Japan; India; Bangladesh.

Key to species of *Rhamphophasma* from China

1. Female ························ 2
-. Male ························ 5
2. Anal abdominal segment shorter than combined length of eighth and ninth abdominal tergites ························ *R. obtusum* **sp. nov.**
-. Anal abdominal segment longer than or as long as combined length of eighth and ninth abdominal tergites ························ 3
3. Anal abdominal segment curved upwards ························ *R. serratum* **sp. nov.**
-. Anal abdominal segment straight ························ 4
4. Posterior apex of abdominal subgenital plate not surpassing posterior apex of anal abdominal segment ························ *R. dianicum*
-. Posterior apex of abdominal subgenital plate surpassing posterior apex of anal abdominal segment ························ *R. pseudomodestum* **sp. nov.**
5. Anal abdominal semi-tergites curved ························ *R. obtusum* **sp. nov.**
-. Anal abdominal semi-tergites straight ························ *R. dianicum*

1. ***Rhamphophasma dianicum*** **Chen & He, 1994** (Figs. 1, 2)

Rhamphophasma dianicum Chen & He, 1994: 104 (Type locality: China; type depository: Beijing Forestry University, Beijing, China); Otte & Brock, 2005: 308; Chen & He, 2008: 342; Hennemann *et al.*, 2008: 35.

Specimens examined. 1♂, **China,** Yunnan, Dali, 06-XI-1986, Gangrou XIAO & Jian WU (BFU); 1♂9♀, Yunnan, Dali, 25–26-IX-1991, Juyao LIU *et al.* (SEM); 1♂1♀, Sichuan, Miyi, 26-IX-1980, unknown collector (SEM).

Female. General colour of body and legs yellowish brown. Body slender and cylindrical. Legs distinctly unarmed.

Head oval, moderately tapering posteriorly after compound eyes. Vertex unarmed. Occiput flat, median and lateral longitudinal furrows distinct. Compound eyes small and rounded. Antennae short, apices just surpassing middle area of profemora, with 20–22 segments, sparsely covered with short bristles; scapus elliptical and flattened, median longitudinal carina distinct, longer than combined length of pedicellus and third segment; third segment cylindrical, longer than pedicellus.

Thorax densely covered with small granules. Pronotum rectangular, longer than wide, shorter than head, with longitudinal and transverse sulci crossing at middle point, anterior margin curved inwards, posterior margin rounded. Mesonotum parallel-sided, median longitudinal line indistinct. Metanotum shorter than mesonotum, parallel-sided.

Abdomen cylindrical and slender, tapering posteriorly. Median segment wider than long. Eighth tergum longer than ninth tergum. Anal segment elongated and tapering posteriorly, longer than combined length of eighth and ninth tergites, posterior apex pointed. Subgenital plate acuminate, tapering posteriorly, apex pointed and not surpassing middle area of anal segment. Cerci small and short, tapering apically, apices pointed.

Legs slender, sparsely covered with short bristles. Unarmed. All femora longer than corresponding tibiae. Profemora incurved basally.

Measurements. Length of body 92.0–93.0 mm; length of head 5.0 mm; length of antenna 11.0 mm; length of pronotum 3.5 mm; length of mesonotum 16.0–17.0 mm; length of metanotum 12.0 mm; length of median segment 3.0 mm; length of profemur 25.0–27.0 mm; length of mesofemur 16.0–18.0 mm; length of metafemur 21.0–22.0 mm; length of protibia 22.0–24.0 mm; length of mesotibia 14.0–15.0 mm; length of metatibia 18.0–19.0 mm.

Distribution. China (Yunnan, Sichuan).

Remarks. Description, illustrations and measurements are the first to be given for the female of this species.

2. ***Rhamphophasma obtusum*** **sp. nov.** (Figs. 3–6)

Female. General colour of body and legs yellowish brown. Body slender and cylindrical. Legs lacking distinct armature.

Head oval, moderately constricted posteriorly after compound eyes. Vertex unarmed. Occiput flat, median and lateral longitudinal furrows distinct. Compound eyes small and rounded. Antennae short, apices not reaching middle area of profemora, with 22–24 segments, sparsely covered with short bristles; scapus elliptical and flattened, median longitudinal carina distinct, longer than combined length of pedicellus and third segment; pedicellus cylindrical, as long as third segment.

Pronotum nearly rectangular, longer than wide, shorter than head, with longitudinal and transverse sulci crossing at middle area, anterior margin distinctly curved inwards, posterior margin truncate. Mesonotum parallel-sided, median longitudinal line indistinct, longer than combined length of metanotum and median segment. Metanotum longer than median segment, parallel-sided.

Abdomen cylindrical and slender, tapering posteriorly. Median segment nearly square. Eighth tergum longer than combined length of ninth tergum and anal segment. Anal segment longer than ninth tergum, shorter than eighth tergum, tapering posteriorly, posterior apex obtuse. Subgenital plate elongated and tapering posteriorly, apex pointed and almost reaching or reaching posterior apex of anal segment. Ovipositor not exposed. Cerci small and short, tapering apically, apices pointed.

Legs slender, sparsely covered with short bristles. All femora roughly as long as corresponding tibiae. Profemora curved basally, unarmed. Protibiae unarmed. Anterodorsal, posterodorsal, anteroventral and posteroventral carinae of mesofemora and metafemora unarmed, medioventral carina with a few small serrations subapically. Anterodorsal, posterodorsal, posteroventral and anteroventral carinae of mesotibiae and metatibiae with a few small spines subapically. Medioventral carina of mesotibiae and metatibiae with a slightly raised lobe basally.

Male. Yellowish brown, dorsal surface of thorax and abdomen with black longitudinal stripes. Body slim and slender, distinctly smaller and more slender than female.

Head oval, tapering posteriorly. Vertex flat and unarmed, with a pair of small oval depressions between compound eyes. Occiput flat. Compound eyes small and rounded. Antennae damaged and incomplete; scapus flattened basally, almost as long as third segment; pedicellus shorter than scapus.

Pronotum shorter than head, anterior margin curved inwards, posterior margin truncate; transverse and longitudinal sulci crossing at middle area. Mesonotum parallel-sided, longer than combined length of metanotum and median segment, median longitudinal line indistinct. Metanotum longer than median segment.

Abdomen slender. Median segment rectangular, longer than wide. Eighth tergum expanded posteriorly, slightly shorter than ninth tergum. Anal segment longer than ninth tergum, dilated into two distinct semi-tergites; both semi-tergites laterally compressed, tapering posteriorly, weakly curved inwards, apices blunt, inner surfaces with minute teeth. Poculum cup-shaped, tapering posteriorly, posterior margin rounded and not reaching posterior margin of ninth tergum. Cerci short, slightly curved inwards, apices pointed.

Legs slender and long. All femora roughly as long as corresponding tibiae. Profemora unarmed, curved basally. Protibiae unarmed. Anteroventral and posteroventral carinae of mesofemora, metafemora, mesotibiae and metatibia with a few small spines subapically.

Measurements. Length of body ♀ 70.0–87.0 mm, ♂ 57.0–60.0 mm; length of head ♀ 4.0–5.0 mm, ♂ 3.5 mm; length of antenna ♀ 11.0–12.0 mm, ♂ 14.0 mm; length of pronotum ♀ 2.5–3.0 mm, ♂ 2.0 mm; length of mesonotum ♀ 12.0–15.0 mm, ♂ 11.5 mm; length of metanotum ♀ 7.0–8.5 mm, ♂ 7.0–7.5 mm; length of median segment ♀ 2.5–3.0 mm, ♂ 2.0 mm; length of profemur ♀ 21.0–27.0 mm, ♂ 25.0–26.0 mm; length of mesofemur ♀ 13.0–17.0 mm, ♂ 15.0–16.0 mm; length of metafemur ♀ 15.0–27.0 mm, ♂ 20.0 mm; length of protibia ♀ 21.0–29.0 mm, ♂ 28.0–30.0 mm; length of mesotibia ♀ 12.0–17.0 mm, ♂ 17.0 mm; length of metatibia ♀ 15.0–28.0 mm, ♂ 21.0–22.0 mm.

Holotype. ♀, **China,** Yunnan, Mengtsz, Pi Shit Chai, 4500–5500 ft, 06-IX-1934, Ernest R TINKHAM (SYSBM). **Paratypes.** 2♂3♀, Yunnan, Mengtsz, Pi Shit Chai, 4500–7500 ft, 18-VIII-1934, Ernest R TINKHAM & Chauncey BROWNELL (SYSBM); 2♀, Yunnan, Mengtsz, Dragon Noir, 5000 ft, 19-VIII-1934, Ernest R TINKHAM (SYSBM).

Distribution. China (Yunnan).

Etymology. The specific epithet of this new species is derived from the obtuse posterior apex of anal abdominal segment in female and posterior apices of anal abdominal semi-tergites in male.

Remarks. This new species is similar to *Rhamphophasma mallati* Brunner von Wattenwyl, 1907, but can be separated by inconspicuously granulated body and short anal abdominal segment in female and elongate and curved anal abdominal semi-tergites in male.

3. ***Rhamphophasma pseudomodestum*** **sp. nov.** (Figs. 7–10)

Female. General colour of body and legs brown. Body smooth, slender and cylindrical.

Legs distinctly unarmed.

Head oval, moderately tapering posteriorly after compound eyes. Vertex unarmed. Occiput rounded, median longitudinal furrow distinct, lateral longitudinal furrows indistinct. Compound eyes small and rounded. Antennae short, apices not surpassing apices of profemora, with 22–23 segments, sparsely covered with short bristles; scapus elliptical and flattened, median longitudinal carina distinct, almost as long as combined length of pedicellus and third segment; third segment cylindrical, 3 times longer than pedicellus.

Pronotum rectangular, longer than wide, shorter than head, with longitudinal and transverse sulci crossing at middle area, anterior margin distinctly curved inwards, posterior margin truncate. Mesonotum moderately expanded posteriorly, median longitudinal line indistinct, with a few small pits marginally. Metanotum longer than median segment, parallel-sided, with a few of small pits marginally.

Abdomen cylindrical and slender, tapering posteriorly. Median segment nearly square. Eighth tergum longer than ninth tergum. Anal segment elongated and tapering posteriorly, longer than or as long as combined length of eighth and ninth tergites, posterior apex obtuse, with or without a minute emargination. Subgenital plate acuminate, tapering posteriorly, apex pointed and surpassing posterior apex of anal segment. Apices of ovipositor pointed, not reaching or surpassing posterior apex of anal segment but not surpassing posterior apex of subgenital plate. Cerci small and short, tapering apically, apices pointed.

Legs slender, sparsely covered with short bristles. All femora shorter than corresponding tibiae. Profemora curved basally, unarmed. Protibiae unarmed. Posterodorsal, anterodorsal, anteroventral and posteroventral carinae of mesofemora and metafemora unarmed, medioventral carina with a few small serrations subapically. Posteroventral and anteroventral carinae of mesotibiae and metatibiae with a few small spines subapically. Medioventral carina of mesotibiae and metatibiae with a slightly raised lobe basally.

Male. Unknown.

Measurements. Length of body 90.0–108.0 mm; length of head 5.0 mm; length of antenna 12.0–15.0 mm; length of pronotum 3.0–3.5 mm; length of mesonotum 14.0–16.0 mm; length of metanotum 7.5–9.5 mm; length of median segment 3.0–3.5 mm; length of profemur 25.0–31.0 mm; length of mesofemur 15.0–19.0 mm; length of metafemur 19.0–23.0 mm; length of protibia 29.0–35.0 mm; length of mesotibia 16.0–20.0 mm; length of metatibia 22.0–26.0 mm.

Egg. Capsule laterally compressed, rough; black, with brown wrinkles. Micropylar plate elliptical, marginally carinate. Micropylar cup placed at posterior margin of micropylar plate. Median line short, about one-fourth of length of micropylar plate. Operculum elliptical, flat and wrinkled.

Measurements. Length of capsule 4.2 mm; width of capsule 1.2 mm; height of capsule 2.0 mm.

Holotype. ♀, **China,** Guangdong, Shaoguan, Ruyuan, 19-VII-2008, Waichun George HO (HKES). **Paratypes.** 4 eggs, same data as holotype (HKES); 3♀, 9 eggs, Jiangxi, Jinggangshan, 31-VII–2-VIII-2011, Waichun George HO (HKES & SYSBM); 1♀, 1 egg, Guangxi, Xingan, Maoershan, 24-VII-2012, Waichun George HO (HKES); 1♀, W. Jiangxi, Ji’an City, Jinggangshan, Huangyangjie, 1240 m, 26°37'25"N, 114°06'58"E, 28-VII-2014, Jiayao HU *et al.* (SNUC); 5♀, 22 eggs, Guizhou, Jiangkou, 14-VII-2015, Waichun George HO

(HKES).

Distribution. China (Guangdong, Guangxi, Guizhou, Jiangxi). Also in Hunan and Chongqing (Chen & He 1992, 1997).

Etymology. The specific epithet of this new species is derived from the words “pseudo” for “spurious” and “modestum” referring to the close relationship with *Rhamphophasma modestum* Brunner von Wattenwyl, 1893 in the genus.

Remarks. *Rhamphophasma modestum* Brunner von Wattenwyl, 1893 is misidentified in China. In fact, the Chinese material represents a distinct species which is described as *R. pseudomodestum* sp. nov. in this study. Male is not found and this species is believed to reproduce by female obligate parthenogenesis. This new species is similar to *R. modestum*, but can be separated by larger size, more robust body, oval head and more elongate and acuminate anal abdominal segment and subgenital plate.

4. ***Rhamphophasma serratum* sp. nov.** (Figs. 11–14)

Female. General colour of body and legs grayish brown. Body slender and cylindrical, with sparse and inconspicuous granulations. Legs distinctly armed with small serrations.

Head oblong, moderately tapering posteriorly after compound eyes. Vertex armed with a pair of short and small horns. Occiput strongly protruding and rounded, median longitudinal furrow distinct, lateral longitudinal furrows indistinct. Compound eyes small and rounded. Antennae short, apices not surpassing middle area of profemora, with 20 segments, sparsely covered with short bristles; scapus elliptical and flattened, median longitudinal carina distinct, as long as third segment, 5 times longer than pedicellus.

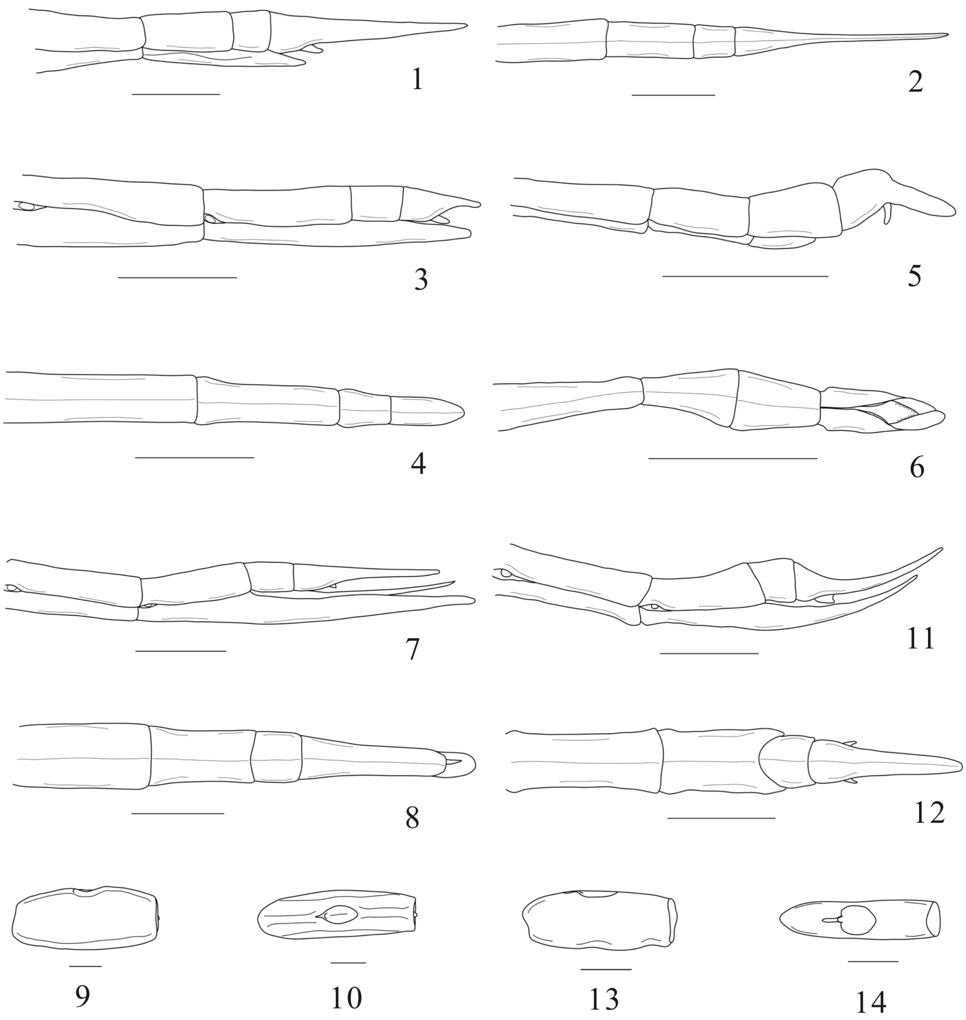
Pronotum rectangular, longer than wide, shorter than head, with longitudinal and transverse sulci crossing at middle area, anterior margin distinctly curved inwards, posterior margin truncate. Mesonotum moderately expanded posteriorly, median longitudinal line indistinct, with a few small pits marginally. Metanotum longer than median segment, expanded posteriorly, with a few small pits marginally.

Abdomen cylindrical and slender, tapering posteriorly. Median segment rectangular, wider than long. Eighth tergum longer than ninth tergum. Anal segment elongated and tapering posteriorly, curved upwards, as long as combined length of eighth and ninth tergites, posterior apex pointed. Subgenital plate acuminate, tapering posteriorly, apex pointed and not surpassing posterior apex of anal segment. Apices of ovipositor not surpassing posterior apex of subgenital plate, apex pointed. Cerci very small and short, tapering apically, apices pointed.

Legs slender, sparsely covered with short bristles. All femora shorter than corresponding tibiae, with small serrations on anterodorsal, posterodorsal, anteroventral and posteroventral carinae. Profemur weakly curved basally. Posterodorsal, anterodorsal, anteroventral and posteroventral carinae of all tibiae with small spine-like serrations. Medioventral carina of mesotibiae and metatibiae with a slightly raised lobe basally.

Male. Unknown.

Measurements. Length of body 84.0 mm; length of head 5.5 mm; length of antenna 8.0 mm; length of pronotum 3.0 mm; length of mesonotum 12.0 mm; length of metanotum 6.0 mm; length of median segment 3.0 mm; length of profemur 29.0 mm; length of mesofemur 18.0 mm; length of metafemur 23.0 mm; length of protibia 37.0 mm; length of mesotibia 22.0 mm; length of metatibia 31.0 mm.



Figures 1–14. *Rhamphophasma* spp. 1, 2. *R. dianicum* Chen & He, 1994; 3–6. *R. obtusum* sp. nov.; 7–10. *R. pseudomodestum* sp. nov.; 11–14. *R. serratum* sp. nov.; 1, 3, 5, 7, 11. End of abdomen, lateral views: 1, 3, 7, 11. ♀, 5. ♂; 2, 4, 6, 8, 12. End of abdomen, dorsal views: 2, 4, 8, 12. ♀, 6. ♂; 9, 13. Eggs, lateral views; 10, 14. Eggs, dorsal views.

Egg. Capsule laterally compressed, densely granulated, brown. Micropylar plate oval. Micropylar cup placed at posterior margin of micropylar plate. Median line short, about a half of length of micropylar plate. Operculum elliptical and flat.

Measurements. Length of capsule 3.0 mm; width of capsule 1.0 mm; height of capsule 1.6 mm.

Holotype. ♀, **China,** Xizang, Motuo, Bangxin, 1410–1850 m, 27-VIII-2013, Wenxuan BI (SEM). **Paratypes.** 26 eggs (extracted from the abdomen of holotype), same data as holotype (SEM).

Distribution. China (Xizang).

Etymology. The specific epithet of this new species is derived from the serrations on legs.

Remarks. The left foreleg of the holotype is lost. The description, illustrations and measurements of eggs are based on the extracted eggs which were removed from the abdomen of the holotypic female and probably in immature stage. This new species is similar to *Rhamphophasma pseudomodestum* sp. nov., but can be easily separated by paired horns on vertex of head, oblong head and distinctly serrate legs.

Acknowledgements

The author wishes to deeply thank Wenxuan BI (Shanghai, China) for providing phasmid specimens collected from Xizang, China; the staff of Maoershan Nature Reserve, Guangxi, China and Jinggangshan Nature Reserve, Jiangxi, China for their kind assistance; Beijing Forestry University, Beijing, China (BFU), Shanghai Entomological Museum, Chinese Academy of Sciences, Shanghai, China (SEM), Shanghai Normal University, Shanghai, China (SNUC) and Museum of Biology, Sun Yat-Sen University, Guangzhou, Guangdong, China (SYSBM) for giving access to the corresponding collections and loan of specimens; and the anonymous reviewers for providing comments and suggestions to improve the manuscript.

References

Bragg PE. 2001. *Phasmids of Borneo*. Natural History Publications (Borneo), Kota Kinabalu, 772 pp.

Brunner von Wattenwyl K. 1893. Révision du Système des Orthoptères et description des espèces rapportées par M. Leonardo Fea de Birmanie. *Annali del Museo Civico di storia naturale Giacomo Doria, Genova*, (2)13(33): 1–230.

Brunner von Wattenwyl K. 1907. *Die Insektenfamilie der Phasmiden, II, Phasmidae Anareolatae* (*Clitumnini, Lonchodini, Bacunculini*). Wilhelm Engelmann, Leipzig, 157 pp.

Chen SC & He YH. 1992. Phasmida. *In*: Peng JW & Lui YQ (Eds.), *Iconography of Forest Insects in Hunan, China*. Hunan Science and Technology Publishing House, Changsha, pp. 42–49.

Chen SC & He YH. 1994. Descriptions of two new species of Phasmida from Yunnan and Guangxi, China (Phasmida: Phasmatidae: Heteronemiidae). *Acta Zootaxonomica Sinica*, 19(1): 104–107.

Chen SC & He YH. 1997. Phasmatodea: Phasmatidae and Heteronemiidae. *In*: Yang XK (Ed.), *Insects of the Three Gorge Reservoir Area of Yangtze River*. Chongqing Publishing House, Chongqing, pp. 113–121.

Chen SC & He YH. 2008. *Phasmatodea of China*. China Forestry Publishing House, Beijing, 476 pp.

Clark JT. 1976a. The capitulum of phasmid eggs (Insecta: Phasmida). *Zoological Journal of the Linnean Society*, 59: 365–375.

Clark JT. 1976b. The eggs of stick insects (Phasmida) – a review with descriptions of the eggs of eleven species. *Systematic Entomology*, 1: 95–105.

Clark JT. 1979. A key to the eggs of stick and leaf insects (Phasmida). *Systematic Entomology*, 4: 325–331.

Clark JT. 1988. The capitula of phasmid eggs: an update with a review of the current state of phasmid ootaxonomy. *Zoological Journal of the Linnean Society*, 93: 273–282.

Clark JT. 1998. The micropylar plate of the eggs of Phasmida, with a survey of the range of plate form within the order. *Systematic Entomology*, 23: 203–228.

Clark-Sellick JTC. 1997. The range of egg capsule morphology within the Phasmatodea and its relevance to the taxonomy of the order. *Italian Journal of Zoology*, 64: 97–104.

Hennemann FH, Conle OV & Zhang WW. 2008. Catalogue of the stick and leaf-insects (Phasmatodea) of China, with a faunistic analysis, review of recent ecological and biological studies and bibliography (Insecta: Orthoptera: Phasmatodea). *Zootaxa*, 1735: 1–76.

Mandal SK & Yadav K. 2010. Some phasmida (stick and leaf insects) of India. *Records of the Zoological Survey of India Occasional Paper*, 318: 1–64.

Otte D & Brock PD. 2005. *Phasmida Species File – Catalog of Stick and Leaf Insects of the World*. The Insect Diversity Association and the Academy of Natural Sciences, Philadelphia, 414 pp.

Shiraki T. 1935. Orthoptera of the Japanese Empire (Part IV) Phasmidae. *Memoirs of the Faculty of Science and Agriculture, Taihoku Imperial University, Formosa*, 14: 23–88.

Zompro O. 2004. Revision of the genera of the Areolatae, including the status of *Timema* and *Agathemera* (Insecta, Phasmatodea). *Abhandlungen des Naturwissenschaftlichen Vereins Hamburg*, (NF) 37: 1–327.